

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	2860	438/149,155,474,479,798.ccls.	US-PGPUB; USPAT	OR	ON	2005/11/10 15:06
L11	2178	10 and @ad<"20030219"	US-PGPUB; USPAT	OR	ON	2005/11/10 15:11
L13	2	((insulator or insulating or insulative or dielectric) and (break near down) and (ion adj beam) and (metal or metallic)).clm.	US-PGPUB; USPAT	OR	ON	2005/11/10 15:10
L14	592	((insulator or insulating or insulative or dielectric) and (ion adj beam) and (metal or metallic)).clm.	US-PGPUB; USPAT	OR	ON	2005/11/10 15:11
L15	468	14 and @ad<"20030219"	US-PGPUB; USPAT	OR	ON	2005/11/10 15:11
L16	2	((insulator or insulating or insulative or dielectric) and (ion adj beam) and (metal or metallic) and failure).clm.	US-PGPUB; USPAT	OR	ON	2005/11/10 15:12

US-PAT-NO: 6875693

DOCUMENT-IDENTIFIER: US 6875693 B1

TITLE: Via and metal line interface capable of reducing the incidence of electro-migration induced voids

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Claims Text - CLTX (1):

1. A method for forming a robust copper interconnect structure having increased resistance to void failure, the method comprising: a) providing a substrate having a conductive layer formed thereon, the conductive layer comprising a copper-containing material and having an insulating layer formed thereon, the insulating layer having an opening that exposes a portion of the underlying conductive layer at the bottom of the opening; b) forming a barrier layer on the substrate so that the barrier layer is formed on the insulating layer and on the exposed portion of the conductive layer in the opening; c) removing a portion of the barrier layer at the bottom of the opening to expose the underlying conductive layer by anisotropically etching the barrier layer to expose the conductive layer at the bottom of the opening; and d) forming a conductive plug with a copper-containing material in the opening such that the bottom of the plug is in contact with the exposed conductive layer.

Claims Text - CLTX (2):

2. The method as in claim 1 wherein the operation of a) providing a substrate includes providing a substrate having a second barrier layer formed between the conductive layer and the insulating layer; and wherein anisotropically etching includes anisotropically etching the barrier layer and the second barrier layer at the bottom of the opening to expose the conductive layer.

Claims Text - CLTX (3):

3. The method as in claim 1 wherein the operation of anisotropically etching the metal barrier layer at the bottom of the opening comprises one of plasma etching, reactive ion etching, and flood ion beam sputtering techniques.

Claims Text - CLTX (4):

4. The method as in claim 1 wherein the operation of anisotropically etching the metal barrier layer at the bottom of the opening comprises plasma

etching the **metal** barrier layer with an etch chemistry that includes at least one of argon, hydrogen, C.sub.z H.sub.y F.sub.x, and SF.sub.x.

Claims Text - CLTX (5):

5. The method of claim 1 wherein the **insulating** layer is comprised of a low-K **dielectric** material.

Claims Text - CLTX (8):

8. The method as in claim 1 wherein the operation of b) forming the barrier layer includes pre-cleaning the substrate using a plasma formed by igniting at least one argon, hydrogen, and C.sub.x H.sub.y F.sub.z, into the plasma and then forming the **metal** barrier layer over the pre-cleaned substrate.

Claims Text - CLTX (9):

9. The method as in claim 1 wherein the operation of b) forming the barrier layer comprises forming the **metal** barrier layer such that the portions of the barrier layer on the **insulating** layer and on the sidewalls of the opening are thicker than the portion of the barrier layer on the bottom of the opening.

Claims Text - CLTX (10):

10. The method as in claim 9 wherein forming the **metal** barrier layer is accomplished using physical vapor depositing a barrier material at an angle.

Claims Text - CLTX (11):

11. The method as in claim 9 wherein the operation of anisotropically etching the **metal** barrier layer at the bottom of the opening is accomplished using a technique selected from among reactive ion etching, plasma etching, flood **ion beam** sputtering techniques.

Claims Text - CLTX (12):

12. The method as in claim 1 wherein the operation of anisotropically etching the **metal** barrier layer at the bottom of the opening is accomplished using a technique selected from among reactive ion etching, plasma etching, flood **ion beam** sputtering techniques.

Claims Text - CLTX (13):

13. The method as in claim 11 wherein the operation of anisotropically etching the **metal** barrier layer at the bottom of the opening comprises plasma etching the **metal** barrier layer with an etch chemistry that includes at least one of argon, hydrogen, C.sub.z H.sub.y F.sub.x, and SF.sub.x.

Claims Text - CLTX (14):

14. The method of claim 11 wherein the insulating layer is comprised of a low-K dielectric material.